RADIOCOMMUNICATIONS AGENCY

Radiocommunications Agency
Waterloo Bridge House
Waterloo Road
London SE1 8UA

Switchboard and General Enquiry Point
telephone number 0(1)71-215 2150
Telex 261969 DTIWBHG

BY FAX AND POST

Mr William F Caton
Acting Secretary
The Federal Communications Commission
1919 M Street NW
Room 222
Washington DC
20554 USA

Tel: 0171 215 2111

Date: 7 March 1995

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ORIGINAL

Dear Mr Caton,

UK Radiocommunications Agency comments on Cellularvision submission to FCC NPRM dated 30 January 1995 entitled " LMDS is not viable in the frequency bands above 40 GHz"

I understand that the FCC would welcome the Radiocommunications Agency comments on the Cellularvision submission, in response to your recent Notice of Proposed Rule Making , entitled "LMDS is not viable in the frequency bands above 40GHz ". Your name has been given to me as the person to write to in this context. If this is not the case would you please be good enough to pass it on to the appropriate person.

It seems your deliberations concern inter-alia the relative merits of 28GHz and 40GHz for local multipoint video distribution services (LMDS).

We have studied the Cellularvision Report and, before offering more detailed comments on those particular areas of the report which deal with the European situation and which reference the Report of the UK 40 GHz Working Group (November 1993), we would firstly like to say that,

i) by any objective engineering considerations on this matter , what works or can be made to work at 28GHz will work or can be made to work at 40GHz, and,

ii) that it is not in doubt that larger coverage areas are possible at lower frequencies than 40GHz , for example at 29 GHz, due primarily to the increase in atmospheric losses and rain attenuation with increasing frequency.
By way of a simple comparison, our calculations show that when only atmospheric losses and rain attenuation (rain zone G) are taken into account,

with other important system parameters held constant e.g. 64 degree sector antenna, the coverage distances at which a C/N of 12 dB is achieved for the 99.9% and 99.7% time availabilities are as follows;

Availability	29GHz	41.5GHz
99.7%	7.2 km	4.5 km
99.9%	5.35 km	3.4 km

Furthermore, you will not need reminding that selective use of engineering information, out of context, can be misleading.

The following more detailed comments are offered in order to clarify the European situation and the references by Cellularvision to the UK 40 GHz Working Group Report:-

1) The CEPT has harmonised the band 40.5 to 42.5 GHz for MVDS through Recommendation T/R52-01 in 1990. Since then 11 countries have implemented the recommendation, 8 countries plan to and 2 will not. Implementation means allocation of the band for MVDS

2) Whilst we are not able to speak for other European countries, in the UK 40 GHz MVDS use has been dependent on the release of Local Delivery Licence (LDO) franchises by the Independent Television Commission. The LDO licence was introduced to be "technology neutral" such that cable operators would have freedom within their franchise to use cable and/or 40 GHz MVDS in their network architecture. Furthermore the performance specification MPT1550, facilitating the type approval of 40 GHz equipment, was not published until September 1993. Therefore it is not correct to state that cable is being offered due to the inability of 40 GHz MVDS to serve subscribers; the legislation gives our Local Delivery Operators the choice, where previously they were constrained to use cable.

3) The first such franchise was awarded to Eurobell for West Kent in August 1994. They have indicated that they will implement a digital MVDS system at 40 GHz covering 33,000 (~1/3) of the homes in the franchise area, comprised of those in outlying villages and smaller towns.

4) The reconvened 40 GHz Working Group, chaired by the Radiocommunications Agency, is now addressing the requirements and specification for digital MVDS including interactive/back-channel issues. No firm decisions have been made but clearly a return path is necessary, with possibilities of it being located in-band, overlaid in another frequency band or via twisted pair. Therefore the potential

for interactivity is certainly not bleak, however it is important to note that the requirement for the return path was not identified as important by potential operators/industry during the development of the analogue MVDS specification (MPT1550). The main driver then was a low cost one way video service which was alternative to and cheaper than cable, utilising existing satellite type indoor receiver decoders. However due to timing and economic considerations over the release dates of the new franchise areas, digital MVDS is now more likely to be implemented than analogue.

5) It has always been recognised that the size of MVDS cells at 40 GHz is considerably reduced during rain fades. Therefore 40 GHz is better suited to lower rain rate climates, whether in Europe or the Americas. We note that there are large areas of North America which have similar low rain rates to Europe. Therefore we do not agree with the sweeping statement that 40 GHz MVDS is not viable in US climates. A similar consequence with respect to the rain faded coverage area is the availability being specified by Cellularvision of 99.9% time (~9 hours/year) which is higher compared to the UK criterion of 99.7% time (~27 hours/year). This is one of the many reasons that the performance/cost comparison made against the UK system is not valid.

6) The 40 GHz Working Group report in its general statement on page 6, regarding transmission over a few kilometres, has to be read in context. It was recognised that with the improvements possible in semiconductor technology, for RF power generation and receiver noise figures at 40 GHz, increased performance would provide increased range. The MVDS link budget in our report uses rain attenuation figures based on ITU-R rain zone G, giving 7 mm/hour for 99.7% availability and not 2.1 mm/hour as wrongly stated in the Cellularvision report. (7 mm/hr gives ~2.1 dB/km). To put this into perspective, the report gives an assessment of the distribution of average annual UK rain fade events, indicating that for 99.7% availability there would be approximately 300 fades each of duration 30 seconds reducing to 40 fades per year exceeding 4 minutes.

7) We do not agree with the parameters used in the assessment of the link budget in Table 1 of the Cellularvision submission. 40 GHz MVDS planning uses an effective channel of 8 dBW using the 64° sector coverage horn antenna, and not 2 dBW as stated. The receive antenna gain is at least 32 dBi and not 29 dBi as stated, this value being already achievable in production quantities for 38 GHz fixed link equipment. Our C/N for planning purposes has been 12 dB and not 16 dB as stated. The result of the use of these incorrect planning parameters is to further degrade the 40 GHz coverage distance calculated as compared to 29 GHz. Similarly the table assumes the same availability of 99.9% time, whereas we have set our availability at 99.7% time in line with the Broadcasting Satellite Service, thus further distorting the 40 GHz scenario. In

any objective comparison of two frequency bands, it is necessary to compare like with like; clearly Cellularvision have not done this in their submission.

8) The use of the 64° sector coverage antenna was chosen to maximise spectrum efficiency, providing essentially circular coverage from the edge of the coverage area while under rain faded conditions at the availability defined of 99.7% time. Further benefits accrue from this antenna compared to an omni, for example in the choice of transmitter location anywhere on the cell boundary and in its directivity allowing reduced frequency re-use distance. It was not chosen for reasons of sidelobe suppression, cross polarisation, oscillator-stability, phase noise or power combining limitations as stated on page 13.

9) The frequency re-use figure of 20 to 30 km was thought judicious as a first approximation for initial planning exercises in the absence of detailed propagation measurements at 40 GHz. Obviously with careful selection of transmitter locations, terrain screening and azimuthal angle on the transmit antenna, better re-use will be possible in practice. Initial indications from the UK's propagation experiments point to there being significant enhanced propagation clear air effects. Therefore our cautious first approximation will be modified as appropriate when the propagation results are available. We believe this to be a responsible way to manage the planning of a broadcast service to the level of quality and availability required.

10) UK manufacturers have indicated that it will be quite feasible to make HEMT MMIC devices able to provide the filtering and power combining necessary to feed one 64° antenna per transmitter. Using a modular approach, a given percentage of redundancy in the form of standby channels will be available, rather than having two identical TWTAs, with one on permanent hot-standby. The whole concept of 40 GHz has been to keep the cost down by utilising existing standard low cost indoor satellite receiver decoders. This continues to be our philosophy for digital MVDS where we intend to adopt the MPEG2-DVB-S system parameters.

11) The UK 40 GHz MVDS specification uses 29.5 MHz channel spacing and 26 MHz bandwidth for one reason only. This is to be compatible with existing low cost satellite indoor receiver decoders. The 4 group 32 channel plan has been maximised to these parameters using frequency interleaving and orthogonal polarisation between adjacent coverage areas. The 20 MHz bandwidth used by Cellularvision is again not a valid comparison, the UK 26 MHz value being due to the increased necessary bandwidth for frequency modulation of PAL/I encoded video rather than NTSC.

12) The recognition in our report that 40 GHz MVDS cannot compete with cable was in the context of analogue one-way broadcasting compared with broadband cable / telephony overlay / optical fibre possibilities for the future. Clearly with 2 GHz of spectrum available at 40 GHz, with digital compression techniques, multiprogramme

and interactive back-channel possibilities, there is the possibility of head-on competition to cable, particularly when one looks at costs. Previous UK comparisons of cost have been between 40 GHz MVDS and cable. Comparisons with equivalent radio systems at lower frequencies will always favour the greater coverage system, however this is not the issue in Europe where lack of spectrum has resulted in the agreement that the long term home for MVDS is at 40 GHz. For the UK cable operators assessing the viability of 40 GHz versus cable, they will be concerned with the breakpoint in terms of number of homes to serve, at which the cost of MVDS falls below the equivalent cable cost. Our original costings for analogue indicated that this point is reached with communities of fairly small number i.e. ~ 400 to 600 homes depending on penetration of 33% or 50%. Another point to bear in mind is that the cost penalty in choosing 40 GHz rather than 29 GHz becomes a small percentage increase when looking at total system costs. This total cost includes all elements in the cable operation such as programme generation / capture, subscriber management, marketing, encryption, signal distribution, civil engineering costs, etc.

13) We are surprised at the conclusion that frequency re-use is not possible at 40 GHz but is at 29 GHz. For reasons stated above, the channel plan has been maximised to ensure best use of the spectrum in four channel groups within the band in the analogue broadcasting scheme. Clearly the interleaving of orthogonally polarised return paths would increase the spectrum efficiency within each cell, however we have yet to see any technical papers relating to the Cellularvision concept, demonstrating the feasibility at 29 GHz, particularly with respect to the reliance on uncharacterised specular reflections within the propagation path. In engineering 40 GHz MVDS, the 40 GHz Working Group has understood the requirement for line-of-sight reception, with the recognition that foliage is a problem at 40 GHz similarly to 29 GHz, necessitating MATV reception in those houses which cannot see the transmitter. It is our view that 40 GHz will be made to work within Europe and that is possesses very similar attributes to a 29 GHz system, albeit with reduced coverage due to rain and atmospheric absorption. Any frequency re-use distance which can in reality be achieved at 29 GHz can obviously be scaled to 40 GHz, assuming planning / system parameters and geometry are held constant.

To Conclude :-

- We believe that cost comparisons between 29 and 40 GHz are not valid in the UK deployment scenario. MVDS is being offered to cable operators as an alternative delivery medium. In cost terms it can serve equivalent cabled areas at a lower cost given the size of currently available 40 GHz coverage areas. Technology improvements will increase the size of these coverage areas. With digital multiprogramme MPEG2 and efficient modulation and channel coding techniques, very similar channel capacities to digital cable will be available to the subscriber.
- Our initial frequency re-use figures were conservative due to concern over anomalous propagation at the level of availability being defined. More detailed

planning, taking into account the inherent directivity advantages of the 64° antenna and the reduced protection ratios possible for digital compared to analogue signals will, together with the results of the propagation trials, give an improved re-use distance figure.

- Further development of the total cellular planning concept, as espoused by Cellularvision, taking into account the above refinements, would see an effective alternative to 29 GHz being viable using directional transmit antennas at 40 GHz. This is in a band where 2 GHz of spectrum is exclusively available and which is planned without the reliance on orthogonal polarisation frequency interleaving via random reflective paths, which is a technique that the UK would not have sufficient confidence in supporting until wider operational trials had quantified its performance and reliability, particularly in terms of return paths at 99.9% availability.

I hope the above is of use in your deliberations. If we can be of any further assistance please let me know.

I am copying this letter to Mr Reinhart and Mr Ghazvinian in the USA, and Mr Couillard in Canada, with whom we have been in discussion with on the MVDS frequency question.

Yours sincerely,

Keith Whittingham
Head of Television Broadcasting Section